Subject :

Workshop Report - CPS Community Enhancement: Collaboration & Consensus Building Aligned Across European Policy And Projects

Place :	Hilton Brussels Grand Place	**Date :**	8 December 2017
Coordinator :	Charles Robinson (Thales)	**Project Ref :**	P4CPS/WP6/08-12-17/CRR
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OBJECTIVE

Across Europe there is considerable expertise in the development of Cyber-Physical Systems but a fragmentation of initiatives and efforts. There is **a need to unify European expertise**, including through **visibility of CPS foundations** and by **clear structuring** to **manage CPS complexity and bridges between other technology classes**. Improved understanding **of the ripple effects of funding** on technology within CPS and the relation with **European competitiveness** is of significant importance.

We are seeking to have workshops that focus on supporting the above, particularly **improving collaboration & consensus across the EU funding programmes and CPS community**. This includes Horizon 2020, EUREKA Clusters (ITEA, PENTA, EURIPIDES …), ECSEL and several National Funding schemes. The particular workshop reported here considered existing efforts and opportunities across programmes. Going beyond this there is a need to encourage consensus building and cross-fertilisation across sectors to further consolidate an understanding of links to magnify the impact.

The workshop treated the Programme level but also had representative projects discussing the highlights of Cyber-Physical Systems projects from Horizon 2020, ITEA, ECSEL and EPoSS. The event brings together about 30 professionals from major ICT programme policy makers, researchers and practitioners and is particularly **set to foster exchange on and creating synergies regarding CPS innovation perspectives**. Discussion points and inputs to this event will be taken up by the Platforms4CPS project and fed into the development of improved or new practices within the CPS community.

Next meeting

Place :	tbd	*Date :*	tbd
Written by :	C.R. Robinson	*on :20-02-18*	**Checked by:**
Diffusion :	Participants & Public		

MORNING AGENDA

- Welcome & Introduction
  - Welcome and the aims of the day (Charles Robinson; Thales)
  - Introduction to Platforms4CPS (Meike Reimann; Steinbeis 2i)
- EU Programmes Overviews and Collaboration Initiatives
  - *European Commission & H2020 (Sandro D'Elia; DG Connect, "Digital Industry", EC)*
  - *ECSEL JU (Georgi Kuzmanov; ECSEL Programme Officer)*
  - *ARTEMIS-IA (Laila Gide; Thales)*
  - *EPoSS (Cees J. M. Lanting; CSEM SA)*
  - *EFFRA (Chris Decubber; EFFRA Technical Director)*
- Collaboration between Programmes at Policy Level
  - *Cluster - Systematic (Isabelle de Sutter; Systematic Paris Region)*
  - *Structuring for CPS Clarity (Charles Robinson; Thales)*

AFTERNOON AGENDA

- EU Project Pitches (10' each) H2020 - CPSwarm (Alessandra Bagnato; Softeam)
    - ITEA - FLEX4Apps (Johannes Berg; NXP)
    - ECSEL - AQUAS (Matthieu Pfeiffer, Magillem)
    - EPoSS - SMARTER-SI (Rainer Günzler; Hahn-Schickard)
    - H2020 - Fed4SAE (Isabelle Dor; CEA)
- Collaboration between Programmes at Project Level
    - Cluster - Zentrum Digitalisierung.Bayern- (Maximilian Irlbeck; ZD.B)
- Closing of Workshop

GUEST LIST

Yves Gigase	ECSEL head of programmes, Belgium
Stephan Karmann	Hans-Schickard
Sandro D'Elia	European Commission, Belgium
Rainer Günzler	Hahn-Schickard, Germany
Pierre-Damien Berger	CEA Tech, France
Meike Reimann	Steinbeis 2i GmbH, Germany
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Matthieu Pfeiffer	Magillem, France
Martin Törngren	KTH, Sweden
Laïla Gide	Thales, France
Koen De Bosschere	Ghent University, Belgium
Johannes Linzbach	Festo, Germany
Johannes Berg	NXP, Germany
Isabelle Dor	CEA-Leti, France
Isabelle de Sutter	Systematic Paris-region Cluster, France
Georgi Kuzmanov	ECSEL – JU, Belgium
Daniela Cancila	CEA-LIST, France
Chris Decubber	EFFRA Technical Director, Belgium
Charles Robinson	Thales, France
Chantal Schoen	ARTEMIS-IA, The Netherlands
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Cédric Demeure	Thales, France
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Afonso Ferreira	CNRS, France
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Alessandra Bagnato	SOFTEAM Cadextan, France

MEETING REVIEW

This workshop was effectively setting the scene for starting a shared ongoing activity to look at high level aspects for enhancing programmes and projects.   Meeting participants were favourable with this goal. The high level approach was chosen to minimise potentially sensitive issues and many potential axes were introduced during the day. A synthesis of presentations is described in this report, with a focus on the two discussions that took place. Full presentations are available from https://www.platforms4cps.eu/resources/.

Further sessions would be beneficial to extend the axes of collaboration and structure with priorities and available resources.   Cyber-physical Systems (CPS) was the particular theme for the day, hosted by the coordination and support action (CSA) project Platforms4CPS. This activity's momentum could be continued for instance via other CSAs, but would need to keep a common thread for persistence. Some of the key axes identified included:

- Collaboration enhancements exist across a wide spectrum relating to the environments we provide, the processes, the communication and the supporting tools.
- There was a favourable consensus on improving clarity of CPS and classification of / bridges to the supporting engineering and technologies.
- Discussions for both Programmes and Projects considered support from Digitalisation Clusters. Other common points emerging were also "Directed Communication" (how to get the right information to the right people on time) and "Cascade Funding".
- Planning for the future is of course also a significant influencer, with security arising as a result of both recentralising and decentralising activities. With several current disrupters new regulatory frameworks and market designs are likely to emerge.

Welcome & Introduction

The meeting began with an overview of the day by *Charles Robinson (Thales)* and followed by an **introduction of the project Platforms4CPS** by *Meike Reimann (Steinbeis 2i)*.   It was emphasised that the day needed us to put aside particular interests or possible competition and focus on enhancing global aspects for collaboration. The project Platforms4CPS is a coordination and support action for the European Commission, beginning the second half of its two years. It has key objectives of "creating the CPS vision, strategy, technology building blocks and supporting ecosystem for future CPS platforms". With specific focus on the domains of Transport, Health, Manufacturing and Energy, Platforms4CPS is supported by several groups (including advisory board, CPS specialists mailing list – to which participants are welcome to join) and has an online PlatForum for community input and feedback.

EU Programmes Overviews and Collaboration Initiatives (setting the scene)

The morning session considered collaboration at the European Programme level. The first programme presented was of the **European Commission & H2020** by *Sandro D'Elia (DG Connect, "Digital Industry", EC)*. The funding calls related to CPS and Computing were initially presented and it was noted the specific calls "Customised and low-energy computing" and "Smart Cyber-Physical Systems" were planned to be combined into "Computing technologies and engineering methods for cyber-physical systems of systems" for 2019. Looking at the overarching structure   Digitalising European Industry (DEI) initiative is currently a big driver and with four key focus areas:

- Digital Innovation Hubs [Primarily for small companies, including SAE, I4MS, Robotics, "everywhere phase 3"];
- Partnerships and Platforms [Including connected smart factory and building block PPPs with big data, photonics, 5G, new cybersecurity topic];
- Regulatory Framework [Digital single market. Free-flow of data];
- Skills and Jobs [Cross-border digital work experience. Digital skills and jobs coalition].

This will particularly influence the restructuring of funding mechanisms for FP9 where community feedback is also providing significant impact. A proposal for this new framework is planned for Q3 of 2018 (comment: published in June: http://europa.eu/rapid/press-release_IP-18-4041_en.htm http://europa.eu/rapid/press-release_IP-18-4043_en.htm).   Areas of CPS where the EC will be addressing include: increased AI (inc. free flow of data because AI is based on data), autonomy, cyber-security, trust and acceptance, unsustainable energy consumption (Low developer productivity - related to "information overflow" and other facets of complexity - a lack of appropriate tools).

Georgi Kuzmanov (ECSEL Programme Officer) provided a synthesis of the **ECSEL JU** programme activities. It is a European public-private partnership supporting Research and Innovation in Electronic Components and Systems. This included direct funding from H2020 and national/regional public/private contributions. ECSEL has a particular focus on "Semiconductor technology / Integrated Circuits", "Embedded Software / Cyber-Physical Systems" and "System Integration and Miniaturisation" and is complementary with the other funding programmes. Indeed ECSEL was created four years ago as a union between the industry associations Aeneas, ARTEMIS-IA, EPoSS, also the European Commission and participating states – so this programme has significant experience with the challenges of establishing common directions and collaboration processes. The ESCEL MASP 2018 is an example of this ("technological challenges and topics, across the relevant European ECS supply-chain actors", collaboratively developed ECSEL SRA, integration of ideas from the broad ECS domain, have a topic focused on digital life, topics for merging hardware, software and specialist devices).

Overviews of two large associations contributing to ESCEL JU were then provided.   The association **ARTEMIS-IA** was introduced to the workshop participants by *Laila Gide (Thales)* with significant information provided about the recently completed Strategic Research Agenda (SRA). This has been a joint effort by the three key industry associations in ECSEL JU, coming together to agree on adapters, migration from legacy processes and one system (climate).   This SRA will play an important role in guiding research and accelerating key technologies beneficial to Europe. The association **EPoSS** is also supporting ECSEL where a presentation was provided by *Cees J. M. Lanting (DATSA Belgium)*. This association has a key focus on smart system integration, including integrated micro- and nanosystems with key components being Sensing, Processing, Knowledge base, Actuation, Data communication and Energy Procurement/Storage. The significant parallels with CPS were noted but having different perspectives (proposed as outside-in vs inside out), but also go more into the deeper scale and miniaturization. Greater modelling of the physical world can clarify further such differences. More generally for the ECSEL association it was noted that semi-conductors could be a complementary group to have, with perhaps MEMS being in parallel with EPoSS   Their logo is a collective European trademark which could be used more widely to represent quality of engineering and help address the perceived value of these technologies.

For the programme **Factories of the Future**, representation was provided from the association **EFFRA** by *Chris Decubber (EFFRA Technical Director)*. This is also a public-private partnership with particular emphasis on "Agile value networks", advancing manufacturing processes and services", human-machine synergies, sustainability and "interoperable digital manufacturing platforms". In particular the slides showed some of the structuring taking place in this domain including the Reference Architectural Model Industrie 4.0. Very much in favour of activities to see cross fertilisation between the different H2020 programmes (and domains) including 5G, big data, AI, CPS. Each may have different languages, but representative glossaries and frameworks can help - there is a "Manufacturing Structured Glossary" including - "Personas" (value chain perspective); "Autonomous factories"; Collaborative product-service factories; RAMI framework as part of the glossary; building blocks. EFFRA provide dissemination events to keep their community updated on activities, such as their event on Connected Factories (5-6 Feb).

Collaboration between Programmes at Policy Level Discussion

This discussion had two presentations provided to animate dialogue. The first, presented by *Charles Robinson (Thales)* was on **Structuring for CPS Clarity**. This action within the Platforms4CPS project is looking at establishing fundamental key functions of CPS. One aim is to enable the Public and high level policy makers to clearly identify what is a CPS and how it differs from other technology classes (representation in Figure 1). The other is extension of this to treat the engineering complexity levels (Safety, Performance, Usability, Security and on to Co-engineering). This will provide some solid ground in the scientific community from which to

establish the foundations, ensuring balanced development across the key CPS functions, treatment of the engineering complexity levels and strong bridges to and from the other technology domains (AI, IoT, etc).
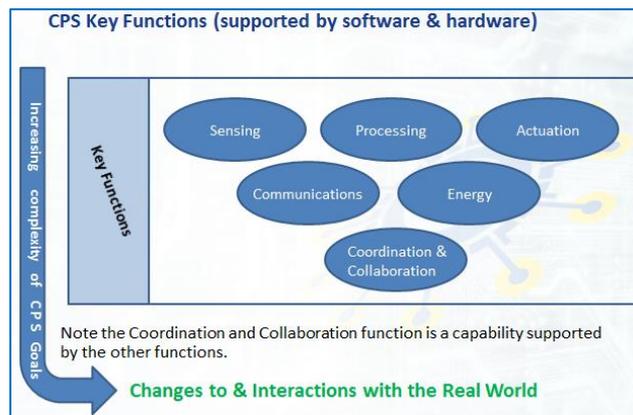

Figure 1: CPS Key Functions.

The second presentation theme was on clusters, an example of one approach that can enhance collaboration activities. For the morning session the focus was on the cluster **Systematic France** presented by *Isabelle de Sutter (Systematic Paris Region)*. This cluster, created in 2005, plays a particular support role for SMEs (460 members) in the CPS domain and connecting them with large industry (150 members). The cluster has three main targets: supporting innovation with a focus on emergence, market entry and promoting successful R&D collaborations; accelerating growth through support of high potential SMEs, technology transfer to industry and promoting attractiveness of member technologies by establishing relevant communication channels at national, European and International levels.

Discussion

Participants of the meeting came from a diverse background from direct technical development, management of technical development, policy making and logistical support. There was some hesitancy by some participants about being addressed as CPS specialists, so it was clarified in the context that both technical and non-technical roles contributed significantly to CPS development. Collaboration enhancements exist across a wide spectrum relating to the environments we provide, the processes, the communication and the supporting tools.

In relation to the structuring for CPS, the approach to increase visibility of the key components met with general agreement. One comment suggested a slight uneasiness about using energy by itself and perhaps it should be management – another noted that EPoSS had a similar separation of functions, but used "Energy and Procurement and storage". The response was that it was also important to keep things as simple as possible (at least for the public) where the use of 'energy' was intended to mean any CPS functions related to energy. However, further discussion to evolve terminology would be welcome via the online forum (https://platforum.proj.kth.se/tiki-index.php?page=Survey+on+Distinguishing+CPS). The question about the strong similarities arose between SSI and CPS and how to address this – it was suggested that they were complimentary but we should be playing on our strengths, with SSI focused on lower levels including materials and CPS on higher levels and abstraction. Related to the engineering complexity levels, the most complex part was considered to be stage two of co-engineering (trade-offs like safety-security) – stage two being the traceability through the product lifecycle.   Metrics here would be linked with the degree of automated design.

One of the participants asked about the differentiating factors of 'actuation', proposing it is about 'modifying' and interactions with the physical world; so perhaps not only in terms of controlled e.g. motors but also involving outputs affecting humans (e.g. displays). This was an interesting point to be brought up, because while actuation is traditionally a physical component of a system that does some physical action – CPS moves things to higher levels of abstraction, so a whole aircraft for instance may be considered "actuation" in air traffic management. (comment: puzzlement indicated about considering an "aircraft" as an actuator – response: this was not intended, but rather abstraction of the act of putting something into motion). However, while this is the case, it is important to keep the sense that actuators represent some kind of physical action on

the environment – a motor is an active component that can directly injure, whereas a monitor is passive (and rather a communication function).

Several points were raised about how clusters might support programmes:
- Clusters can help to provide information (dealing with the fragmented map of funding, open calls);
  and prepare for initiatives including set-up of sub-consortiums.
- matchmaking at regional level.
- matchmaking at EU level ... other means.
- project ideas ... e.g. promoted by ITEA and ECSEL.
- Digital Innovation Hubs - and open calls (cascade funding) - is useful for the clusters.

It was noted that projects should relate with national/ regional initiatives, link would be beneficial for all, awareness of and dissemination activities towards clusters regarding e.g. open calls / cascading funding would be good. Current match making possibilities and tools, in regards to project ideas or web based platform is managed via NCP, EC platform or at dedicated brokerage events. It was noted here that an ECSEL community tool was also used of the EFECS event.

The subject of directed communication was broached – i.e. how to get the right information to the right people on time (but also minimise background noise). ARTEMIS-IA have been working on this, including linking to other organisations, e.g. EFFRA/FoF. At the higher level between the programmes there is the Fedira communication platform connecting to clusters and associations: AENEAS & PENTA; AIOTI; ARTEMIS-IA; BDVA; EFFRA; EGVI; EPOSS; EUCAR; EURIPIDES²; EUROBOTICS; ITEA3; NESSI; Networld2020 & 5G PPP; SPIRE; Steinbeis-Europa-Zentrum.

The topic on improving awareness of EU competition, e.g. w.r.t. ASIA, focused on Cybersecurity and the European Union General Data Protection Regulation (GDPR). For instance security products 'made in Europe' would mean Kaspersky (Russia) and the NSA (USA) out of the game. Security needs to be assured from the ground up i.e. vertical sovereignty, if it is secure by design - "can buy it from US or China", but do I trust it?!?! It was believed cybersecurity was very fragmented across the programs raising general questions about our global strength in the area, competition at the trust level, trusted supply chains and the needed legalisation. This moved on to consider GDPR which was noted to be a catalyst to keep privacy in mind – but there needs to be technology to support implementation. It also means CPS technology will be moving more towards security by design and improved trust in systems and producers. However the legislation remains broad and not fully understood by all (with other components like the right to be forgotten and E-privacy). (comment: funding domino effects for competitive edge maybe also be relevant for future consideration – perhaps linked with cascade funding)

EU Project Pitches (setting the scene for the afternoon discussion)

The second half of the day was devoted to looking at collaboration aspects related to the project level. This began by presenting examples of CPS-related projects from across the different funding programmes. The **H2020** project **CPSwarm** was the first to be described and represented by *Alessandra Bagnato (Softeam)*. This project advances technology for managing emergent behaviour of interacting autonomous systems with the first of three years complete. In particular the project considers the science of systems integration in the domain of swarms of CPS. It will put in place a framework consisting of development work, a models library, simulation environment and deployment toolchain to significantly aid complex autonomous CPS.

Following this the project **FLEX4Apps** was presented to the workshop audience by *Johannes Berg (NXP)*. This project is under the Smart Engineering challenge within the **ITEA** programme and has two of its three years remaining. It will provide a platform for application and infrastructure flexibility in CPS, taking into consideration the increasing ubiquitous connectedness of technology and move towards open source. The foundation of the platform will be for enabling data monitoring in different environments and other challenges. It was noted that software is becoming a commodity - so we should make use of this. However there is a paradox here because there are lots of opportunities, but how does ne make revenue –this may come from adding HW for added value, data analytics or via general services.

The project **AQUAS** is seven months into its three years and had an overview provided by *Matthieu Pfeiffer (Magillem)*. It is funded through **ECSEL** where its raison d'être is that managing safety, performance and security interactions for products and through their lifecycle is becoming a big impediment to building complex (cyber-physical) systems. The consortium is working to especially generate momentum for the adoption of increased co-engineering across industry. Optimisation and automation of co-engineering will be a significant accelerator for the uptake of new technologies and digitalising Europe. It was asked if tools were currently in use for managing the trade-offs, but this maturity has not yet been reached. There are many tools being integrated, but the focus of the project is in generating a reference methodology (a concept framework on which to base the tool trade-off management).

Smarter-SI was presented by *Rainer Günzler (Hahn-Schickard)*. It is funded by **H2020** through the **EPoSS** an industry-driven policy initiative for smart systems integration and almost completed. The particular objectives of this project are improving the capability to access/integrate production done in small lots (primarily SMEs) – smart access to Manufacturing for systems integration. The concept is called the Cooperative Foundry Model, with more than 30 different components being tested within the project on 11 applications. The premises are that RTOs should do real manufacturing, with innovation by cooperation, however the required trust is often underestimated. It was noted that European MEMS and microsystems are world top leaders.

Isabelle Dor (CEA) introduced the workshop members to **FED4SAE**, a project funded by **H2020** that in fact funds smaller projects (cascade funding). Its key goal is to accelerate European CPS solutions to the market and in particular by having technologies connect to platforms and by connecting technologies with investors across value chains. It launches open calls for proof of concepts and business plans from SMEs and when they are accepted requires a good degree of innovation management providing clues about sustainability. A similar activity was mentioned called "Kicks" but has less freedom than Fed4SAE. Additional benefits included that both Hardware/Software people in the same room (where each often takes the other as a given), and that measures/hurdles of scale are possible – big players sell / in millions and SMEs possibly hundreds of products.

Collaboration between Programmes at Project Level Discussion

Again clusters represent a means of aiding collaboration at this level. Thus the afternoon discussion session was launched by *Maximilian Irlbeck (ZD.B)* describing the cluster **Zentrum Digitalisierung.Bayern** (ZDB). This cluster was established in 2013 and has a focus on digitalising Bavaria (population of 12.7 million) with 7 Topic Platforms to achieve this. It consists of five entrepreneurship education centres, 10 Innovation Labs and funds 40 research positions (from graduate to professorship level). Headquarters are based in Munich, but is part of an "ICT hub in Europe" together with Paris and London. Maximilian is associated with the Topic "Platform for Digitalisation of the Energy Sector". There is significant change in this sector where it is believed charging for energy will increasingly become unfeasible. Companies are considering and moving towards new services built on top of the basic energy provision. In addition there is the continued transition to renewable energy. ZD.B brings the private and public community together discussing market design and regulator frameworks, including related ministries. Key goals they are working towards are to be Green, Clean, Efficient, Reliable, Stable, Safe and Secure.

Discussion

The afternoon discussion initially focused on support from clusters and with an energy focus. Customers are increasingly becoming prosumers, they play a more active role in also providing energy. There is also a steady migration towards renewable energies. This means technologies are emerging to manage the evolution towards a decentralised form. It includes for instance the reuse of energy from new instalments in some houses distributed to other houses. Safety and security are of course critical here, with a note being made that Europe is the global leader for energy blockchain. Discussing the structure of the ZDB cluster, it is sitting in Bavaria and more of a national level focus and related to energy they do not deal with the transmission level (this is European Level).

A question was raised about non-national organisations wishing to join or propose a project for national cluster support (like ZDB). This could also be a Tech. or Business exchange with someone outside. At least for ZDB, Bavaria would take priority, but from outside, yes it is possible to have someone knock on the door.

While it is often good to establish good examples to lead the way, there seems to be enough lighthouses in this domain – we now need to move from admiring to implementing things.   With selling energy increasingly becoming a lost cause we need to look to new forms of services. This raises general questions including establishing the right regulatory framework, market design, different environment for startups.   It is also important to try to connect ideas. All these points relate to an axis on planning for the future which of course has significant influence on research priorities.

Moving out on a more general level, directed communication is also strongly relevant at project level, especially for proposals. Clusters in particular support communication to guide information to the right people, but it would also be good to see more inter-cluster links established – and here building trust and personal connections is considered important.

For R&D&I calls, there exists a lot of companies that could apply but who are not aware. It is not simply a question of getting more people connected as this can lead to too many applying to a call – with a loss of time and resources for unsuccessful applications. It is a case of getting information to the more relevant people (comment: while providing transparency) and producing well adapted proposals.   A suggestion here was for the dissemination of calls, in the portal to try and "toy" the calls. Also often SMEs have insufficient time to read calls. Profiling the calls could help here and with the directed communication.

A variety of models and approaches may be needed. Europe has a tendency of doing big and wide because otherwise likely to be too small and unmanageable. However, more focused activities with really small scale also needed in range 10 000 – 100,000 euros. Again clusters could support here, but also cascade funding may be a solution. EuroCPS seems a suitable example here. Smaller platforms also enable B2B and people to meet to tackle the micro level. It was noted there were not many for manufacturing (but the Connected Factories initiative is an example).   This topic prompted a question on types of funding to encourage Business Transformation – apparently some funding frameworks provide a 'Digital Bonus' such as 10, 0000 euros where proof of technology use is provided. This may be a good approach to help get the technology out into the market, but to generate a market pull may need 10 or 100 enterprises to adopt a technology. It may also be needed to encourage evolution of industrial processes so they can adopt technologies easier.